Environment Canada Environnement Canada

OCEAN DISPOSAL CONTROL PROGRAM

OCEAN DISPOSAL ACTIVITIES SUMMARY 1995

REGIONAL PROGRAM REPORT: 97-28

PACIFIC AND YUKON REGION

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OCEAN DISPOSAL ACTIVITIES SUMMARY

1995

PACIFIC AND YUKON REGION

ENVIRONMENT CANADA
ENVIRONMENTAL PROTECTION

PACIFIC AND YUKON REGION

Report No. 97-28

Regional Program Report by:

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ABSTRACT

Environment Canada's administration of the Canadian Environmental Protection Act (CEPA) Part VI, regarding ocean disposal of wastes, is summarized in this report. Disposal activities from January 01, 1995 to December 31, 1995 in the Pacific and Yukon Region are specifically documented. The sites in this region are used primarily for disposal of dredge and excavation spoils. Activities at these sites from 1975 to 1994 have been compiled in a series of reports by Ward and Sullivan (1980), Sullivan (1987), Kim and Sullivan (1993), Kim et al.(1997), and Sullivan et al.(1997). This report is a continuation of this series and includes information on ten disposal sites that were active in the Pacific and Yukon Region in 1995. Data are presented for monitoring done at three of these sites.

RÉSUMÉ

Ce rapport concerne les activités d'Environnement Canada en matière d'application de la partie VI de la Loi canadienne sur la protection de l'environnement (LCPA) (dépôts de déchets en mer). Il traite plus spécifiquement d activités de dépôt qui ont eu lieu du 1er janvier au 31 décembre 1995 dans certains sites de la région du Pacifique et du Yukon. Les sites de cette région servent principalement du dépôt des materiaux de dragage et d'excavation. Les activités de dépôt pour la période comprise entre 1975 et 1994 ont été compilées dans une série de rapports préparés par Ward et Sullivan (1980), Sullivan (1987), Kim et Sullivan (1993), Kim et al. (1997) et Sullivan et al. (1997). Ce rapport s'incrit dans cette série et contient de l'information sur les activités de 10 sites de dépôt dans la région du Pacifique et du Yukon au cours de l'année 1995. Les données fournies concernent les contrôles effectués dans 3 de ces sites.

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1.0 INTRODUCTION

Environment Canada has administered the requirements for ocean disposal of wastes since 1975 under authority of the Ocean Dumping Control Act (ODCA). In 1988 this legislation was replaced by the Canadian Environmental Protection Act (CEPA), Part VI. Material destined for ocean disposal or loaded for the purpose of ocean disposal requires a permit issued by Environment Canada. To ensure compliance with the conditions of the permit, inspections are routinely conducted by Environment Canada, Enforcement and Emergencies Division.

Within Canada, ocean disposal sites are divided into four geographical regions: Atlantic, Prairie and Northern, Quebec, and Pacific and Yukon (Figure 1 shows the Pacific and Yukon Region). This report describes all activities conducted in 1995 by the Ocean Disposal Control Program in the Pacific and Yukon Region.

There are thirty-five designated disposal sites in the Region. In 1995, eleven of these disposal sites were used and three were monitored (Table 1). Disposal sites are designated in this report using the numbering system from Ward and Sullivan (1980), Sullivan (1987), Kim and Sullivan (1992), Kim et al. (1997), and Sullivan et al. (1997). Where information is available, loadsite and monitoring information for each disposal site is presented in Section 5.0. Detailed information on disposal activities that occurred in 1995 under specific permits and approvals can be found in the Ocean Disposal Site Summaries in Appendix I.

Figure 1. Location map.

Table 1. Active ocean disposal sites.

Number	Disposal Site	Co-ordinates		Volume Disposed in 1995
* 1	Point Grey	49°15.40'N	123°22.10'W	599,301 m3
9	Sand Heads	49°06.00'N	123°19.50'W	724,080 m3
* 32	Porlier Pass	49°00.20'N	123°29.80'W	5,400 m3
* 40	Five Finger Island	49°15.20'N	123°54.60'W	3,900 m3
49	Malaspina Strait	49°45.00'N	124°27.00'W	14,790 m3
114	Thormanby Island	49°27.50'N	124°05.50'W	350 m3
116	Cape Mudge	49°57.70'N	125°05.00'W	7,200 m3
119	Johnstone Strait - Hickey Point	50°27.80'N	126°04.80'W	8,400 m3
120	Johnstone Strait - Hanson Island	50°33.50'N	126°48.00'W	6,000 m3
126	Roberts Bank - Strait of Georgia	50°46.40'N	127°22.60'W	191,000 m3
166	Rum Island - Haro Strait	48°40.06'N	123°17.10'W	2,400 tonnes
TOTAL				**1,560,421 m3 + 2,400 tonnes**

* Monitoring surveys were conducted at these sites in 1995.

2.0 ADMINISTRATION

2.1 APPLICATION AND REVIEW PROCESS

Under the authority of CEPA, Part VI, material destined for ocean disposal or loaded for the purpose of ocean disposal requires an Ocean Disposal Permit. Permit applications are reviewed by Environment Canada with advice from the Regional Ocean Disposal Advisory Committee (RODAC). This committee has representation from Environment Canada, the Department of Fisheries and Oceans and the British Columbia Ministry of Environment, Lands and Parks. Information on the application process can be obtained from Environment Canada, 224 West Esplanade, North Vancouver, B.C., V7M 3H7. Figure 2 shows the complete permitting process.

The public is advised of the application via a Notice of Intent that the applicant publishes in a newspaper local to the area of the proposed activity. The public can address their comments to Environment Canada throughout the application review process. All environmental screenings can be viewed by the public at the Canadian Environmental Assessment Act (CEAA) Public Registry at 224 West Esplanade, North Vancouver, B.C., V7M 3H7.

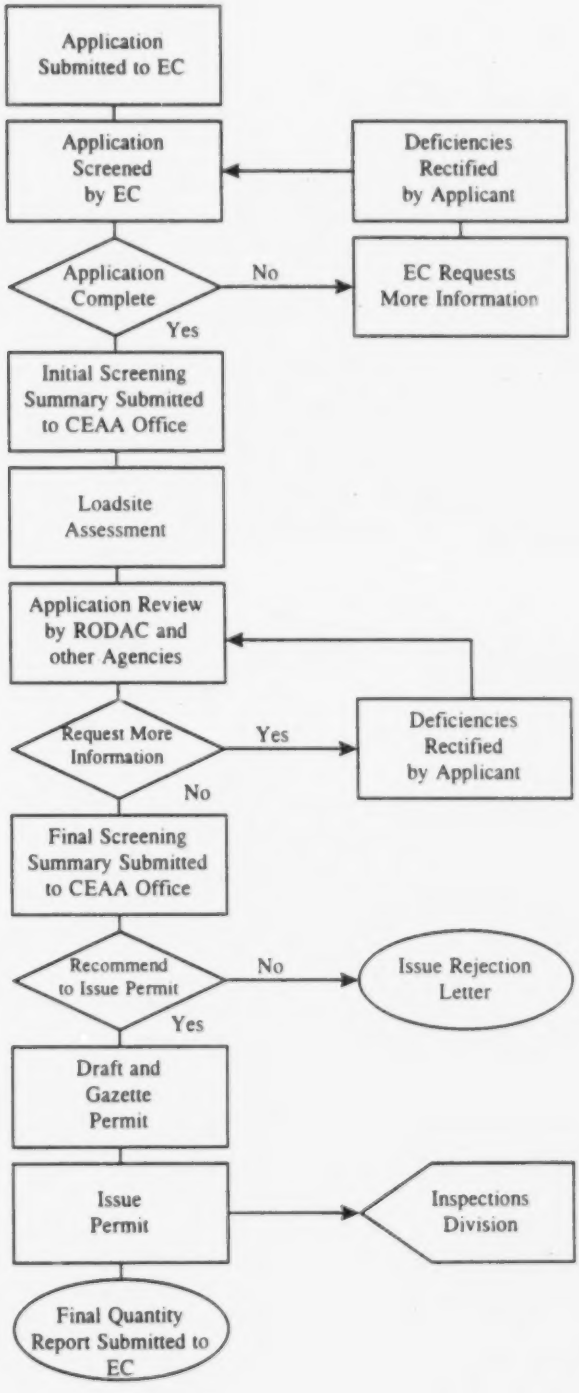
Based on the initial review of an application, inspection and sampling may be required. Following the application review process only material which has been rigorously tested and found to meet the criteria outlined in the Interim Contaminant Testing Guidelines for Ocean Disposal, Pacific & Yukon Region (ICTG, Appendix II) is approved for ocean disposal. All ocean disposal permits and amendments must be published in the Canada Gazette before they are issued. After a permit has been gazetted, a one week time period is reserved for public comments before a permit becomes effective. Permits are valid for a one year period.

Maintenance dredging activities involving less than 4 000 cubic metres of dredged material, or excavation projects involving clean native till may be undertaken under the terms and conditions of a general ocean disposal permit. New dredging projects or maintenance activities involving volumes in excess of 4 000 cubic metres require a site specific permit.

2.2 OCEAN DISPOSAL RESTRICTIONS

Under Schedule III, Parts I and II, certain substances are prohibited or restricted from ocean disposal. In addition, the ICTG further outline the criteria for polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorophenols and dioxins/furans.

The substances listed in Part I are generally prohibited when present at concentrations in excess of those specified below unless, in the opinion of the Minister, the substance will



RODAC Agencies

DOE -	Pollution Prevention and Assessment Division
DFO -	Science and Research
DFO -	Habitat Management
MOELP -	Pollution Prevention and Remediation Branch

Legend

EC -	Environment Canada
RODAC -	Regional Ocean Disposal Advisory Committee
MOELP -	Ministry of Environment, Lands and Parks
DFO -	Department of Fisheries and Oceans
CEAA -	Canadian Environmental Assessment Act

Figure 2. Ocean disposal permitting process.

be rapidly rendered harmless by physical, chemical or biological processes of the sea at the specified disposal site:

a) Organohalogen compounds

• Chlorophenols (PCP and TCP)	1.0 µg/g
• Polychlorinated biphenyls (PCB)	0.1 µg/g
• Polynuclear aromatic hydrocarbons (PAH)	* 2.5 µg/g
• Dioxin (2,3,7,8 TCDD)	* Quantifiable

* ICTG rejection limit

b) mercury and mercury compounds in a solid phase of a waste (0.75 µg/g), and in the liquid phase of a waste (1.5 µg/g);

c) cadmium and cadmium compounds in the solid phase of a waste (0.6 µg/g), and in the liquid phase of waste (3.0 µg/g);

d) persistent plastics and other persistent synthetic materials (four percent by volume), in a suitably comminuted form;

e) crude oil and its wastes, refined petroleum products, petroleum distillate residues and any mixtures containing any of those substances (any quantity that yields more than 10.0 µg/g of n-hexane soluble substances);

f) radioactive wastes and other radioactive matter;

g) substances in whatever form produced for biological and chemical warfare; and

h) industrial waste, namely, material that comes from manufacturing or processing operations and is waste, other than:

- dredged material
- fish waste or other organic matter that comes form industrial fish processing operations;
- ships, platforms or other anthropogenic structures at sea, provided that material capable of creating floating debris or otherwise polluting the marine environment has been removed;
- uncontaminated inert geological material; and
- uncontaminated organic matter of natural origin.

Under Part II, the following substances are restricted when present in significant amounts:

a) arsenic and its compounds;

b) lead and its compounds;
c) copper and its compounds;
d) zinc and its compounds;
e) organosilicon and its compounds;
f) cyanides;
g) fluorides;
h) pesticides and their by-products not included in the List of Prohibited Substances in Part I;
i) beryllium and its compounds;
j) chromium and its compounds;
k) nickel and its compounds;
l) vanadium and its compounds;
m) containers and scrap metal;
n) substances that by reason of their bulk would interfere with fishing;
o) substances that, though of a non-toxic nature, may become harmful due to the quantities in which they are dumped, or that are liable to seriously reduce amenities.

In dredged material, lead is considered to be present in significant amounts when contained in wastes at concentrations of 0.05% or more by weight (500 µg/g) and arsenic, copper, zinc, beryllium, chromium, nickel and vanadium when present at concentrations of 0.1% (1000 µg/g). Pacific RODAC considers these levels as general guidelines only and may impose more stringent limits.

In order to protect fisheries resources, spawning areas, and juvenile and adult migratory areas, the Department of Fisheries and Oceans (DFO) requires that dredging and/or ocean disposal activities be conducted within time frames specified by district Habitat Management Units. Proponents are directed to contact the appropriate DFO units prior to commencing any projects for timing restrictions relevant to the area of proposed activities. For example, Fraser River dredging guidelines for operations within navigation channels specify periods when clamshell or suction dredging is allowed. Dredging outside navigation channels is reviewed on a site-specific basis.

2.3 COMPLIANCE AND ENFORCEMENT

Environment Canada conducts pre-load inspections to confirm sampling program design and collects samples as required. CEPA inspectors routinely conduct compliance and surveillance inspections of dredging/loading and disposal operations. Vessel Traffic Management Centres monitor disposal sites to ensure disposal activities occur at the authorized locations. Any contravention of permit conditions are dealt with under authority of CEPA, Part VI or Section 36 (3) of the Fisheries Act.

3.0 ENVIRONMENTAL ASSESSMENT

Under Phase II of the Green Plan initiative, environmental assessment procedures are being revised. The Interim Monitoring Guidelines for Ocean Disposal were developed and field tested in 1993 and 1994. Three of five biological testing protocols - the Marine Amphipod Acute Toxicity Test, the Echinoid Fertilization Assay and the Bacterial Photoluminescence test (Microtox®) - completed in 1992, were used in field trials to assess their value in disposal site assessment. Development continues on the Polychaete Growth test and the Bioaccumulation assay protocols.

In addition, Environment Canada published 'Guidance Document on the Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing' in December 1994. Biological monitoring guidelines and technical guidance on physical monitoring documents are also being prepared for use in the program.

4.0 OCEAN DISPOSAL ACTIVITIES

4.1 NUMBER OF PERMITS

In 1995, 21 permit applications were received and 25 permits were issued (Table 2). Four permits issued were for the disposal of excavation material, 20 were for dredge material and one was for the disposal of the decommissioned naval vessel *MacKenzie*.

In 1995, a portion of a dredging project at the MacMillan Bloedel Canadian White Pine Division in New Westminster was rejected for ocean disposal. Samples from a small area of the site exceeded ICTG criteria.

Table 2. Number of permits issued in the Pacific and Yukon Region - 1987 to 1995.

Permit Type	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
Dredge	33	41	28	25	23	20	21	18	20	229
Excavation	2	5	5	4	4	5	3	2	4	34
Vessel	0	0	1	0	2	2	0	0	1	6
Others	2	2	2	2	1	0	1	0	0	10
Total	37	48	36	31	30	27	25	20	25	279

Under general permits for dredged and excavated materials, 99 projects were assessed and approved in 1995. Thirty-nine approvals were for excavation projects in the lower mainland and 60 were for dredged material.

4.2 VOLUME OF MATERIAL OCEAN DISPOSED

In 1995, 1 560 000 cubic metres of material was disposed of at various ocean disposal sites (Table 1). The Point Grey and Sand Heads disposal sites received approximately 85% of all materials ocean disposed in 1995.

More than 70% of the total volume of sediment ocean disposed in 1995 originated from dredging projects. The balance was generated from various excavation projects in the Lower Mainland. The volume of dredged material sent to ocean disposal sites each year fluctuates due mainly to sediment loading in the Fraser River. In 1995, 604 000 cubic metres of material was sent to Sand Heads disposal site from maintenance dredging of the Fraser River by Public Works Canada.

4.3 MONITORING

Routine monitoring of ocean disposal sites is carried out by Environment Canada to assess physical, chemical and biological effects of disposal operations. In the Pacific and Yukon Region, ocean disposal sites are designated by RODAC. At each disposal site, a grid of sediment sampling stations has been established to allow repeat surveys.

In 1995, three disposal sites - Point Grey, Five Finger Island and Porlier Pass - were monitored to establish chemical concentrations and physical characteristics of sediments at each site. Analysis of the sediments included trace metals, PAHs, total organic carbon and particle size distribution. At the Five Finger Island and Porlier Pass disposal sites, analyses additionally included PCBs, ammonia, sulphide, and redox potential.

Sediment toxicity tests are conducted to determine and monitor effects of sediments on the receiving environment. Three biological test methods were used to determine the potential toxicity of sediments from Point Grey, Five Finger Island and Porlier Pass disposal sites: the marine amphipods acute toxicity test using *Eohaustorius washingtonianus* and *Rhepoxynius abronius*, the echinoid fertilization assay and the solid phase Microtox® test. Results are presented in Section 5.0.

In October 1995, video images of the Porlier Pass and Five Finger Island disposal sites were recorded using the Remotely Operated Platform for Ocean Science (ROPOS), a remotely operated submersible. ROPOS followed predetermined transect lines across each disposal site to examine bottom conditions and evidence of ocean disposal activities. Discussion of the physical monitoring surveys are presented in Section 5.0.

5.0 ACTIVE DISPOSAL SITE INFORMATION

5.1 POINT GREY

Disposal Site:	Point Grey
Number:	1
Co-ordinates:	49°15.40'N; 123°22.10'W
Depth:	210 metres
Total Quantity Disposed Since 1976:	7 137 727 cubic metres

Comments

The Department of Fisheries and Oceans request that Vancouver Harbour and the Fraser River Dredging Guidelines be applied to any dredging projects, subject to approval by the appropriate Habitat Management Unit.

Loadsite Information

Over 392 000 cubic metres of excavated native till from projects in the Lower Mainland was disposed of at Point Grey disposal site in 1995. In addition, almost 212 000 cubic metres of dredged material was taken to Point Grey this year.

Monitoring Information

A benthic chemistry survey was conducted at this disposal site in May 1995. All chemical parameters are within the limits specified in the ICTG, with the exception of total PAH concentration at Station 40. Chemical data are presented in Table 3.

Biological tests were also completed on sediment from Point Grey disposal site. The results are presented in Table 4. Limited toxic responses were observed in sediment from seven of ten stations tested.

Complete details of the study will be presented in a separate Point Grey monitoring report (in preparation).

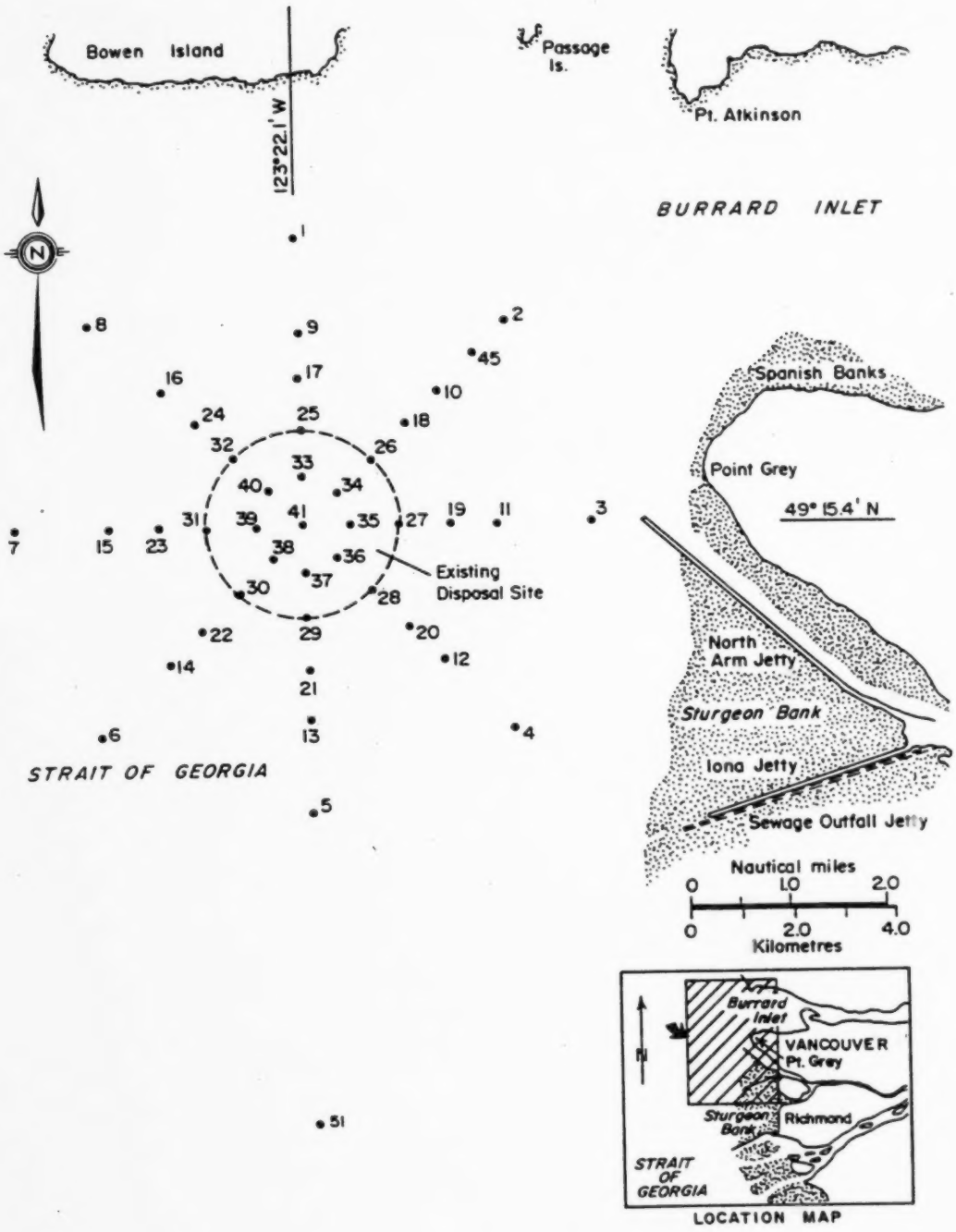


Figure 3. Point Grey ocean disposal site and sediment sampling stations.

Table 3. Point Grey sediment chemistry and particle size - May 1995 survey.

Station	Chemical Data[1]					% Particle Size			
	Cd	Pb	Hg	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 -0.004 mm	< 0.004 mm
7	0.20	25	0.110	0.74	1.15	0.3	1.40	40.3	58.2
25	0.30	10	0.058	0.79	1.25	1.3	33.8	35.7	30.6
27	0.24	< 8	0.054	0.32	1.23	3.7	43.0	33.1	23.9
29	0.25	10	0.070	0.59	2.05	1.4	24.0	41.7	34.4
31	0.28	23	0.085	0.75	1.25	2.4	18.4	37.9	43.7
34	0.36	9	0.053	0.55	1.46	5.7	41.4	33.9	24.7
36	0.27	10	0.035	1.22	1.82	6.9	54.1	29.4	16.5
38	0.25	10	0.067	0.44	1.14	7.2	41.4	36.3	22.3
40	0.21	20	0.055	* 2.92	2.07	7.7	35.6	35.3	29.1
41	0.16	10	0.047	0.74	3.79	6.6	46.5	31.6	21.9

* Indicates concentration above ICTG limits.

[1] Trace metal analyses are presented as total metals.

Table 4. Point Grey bioassay test results - May 1995 survey.

Station	**Amphipod** *E. washingtonianus* % Survival	**Amphipod** *R. abronius* % Survival	**Echinoid** *L. pictus* % Fertilization	**Microtox** solid phase % Effect
7	• 15 ± 7.9	78 ± 12	79.8 ± 8.4	0.112
25	• 47 ± 13	85 ± 12	• 50.0 ± 30.3	0.108
27	77 ± 5.7	94 ± 2.2	65.5 ± 6.2	0.191
29	• 27 ± 19	88 ± 8.4	70.5 ± 9.1	0.156
31	• 51 ± 15	87 ± 9.7	74.3 ± 7.0	• 0.059
34	73 ± 11	86 ± 8.9	80.8 ± 4.9	0.100
36	80 ± 7.9	90 ± 3.5	76.8 ± 9.8	0.436
38	• 66 ± 12	92 ± 5.7	81.8 ± 1.7	• 0.092
40	• 66 ± 11	94 ± 5.5	70.0 ± 5.6	• 0.094
41	80 ± 5.0	77 ± 43	74.8 ± 2.2	• 0.093
Control	97 ± 4.5	100	85.0 ± 1.6	

• Indicates toxic response

5.2 SAND HEADS

Disposal Site:	Sand Heads
Number:	9
Co-ordinates:	49°06.00'N; 123°19.50'W
Depth:	70 metres
Total Quantity Disposed Since 1976:	9 655 079 cubic metres

Comments

The Fraser River Dredging Guidelines, developed by the Department of Fisheries and Oceans apply to all projects. Clamshell dredging may be conducted throughout the year, subject to site specific approval. Suction dredges must operate at five metres depth at low tide from March 1st to June 1st, and in even-numbered years is prohibited from April 15th to May 15th during downstream pink salmon migration.

The Department of Fisheries and Oceans Habitat Management Unit in New Westminster should be contacted for specific timing restrictions for dredging.

Loadsite Information

Only clean sand, silt and gravel, (no woodwastes) are approved for disposal at the Sand Heads disposal site. The majority of material disposed of at this site originates from Fraser River channel maintenance projects by Public Works and Government Services Canada.

In 1995, a project was approved to dispose of 53 000 cubic metres of structurally incompetent Fraser River silt from excavations on Annacis Island. This material was permitted for disposal at Sand Heads as all woodwaste was removed from the material prior to loading for ocean disposal.

5.3 PORLIER PASS

Disposal Site:	Porlier Pass
Number:	32
Co-ordinates:	49°00.20'N; 123°29.80'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	145 435 cubic metres

Comments

The Department of Fisheries and Oceans Habitat Management Unit in Nanaimo (South Coast Division) should be contacted for specific timing restrictions for dredging.

Loadsite Information

Dredging projects at forest industries in Chemainus and Ladysmith resulted in the disposal of 5 400 cubic metres of dredged material at this site in 1995.

Monitoring Information

A benthic sediment survey was conducted on sediment from Porlier Pass disposal site in October 1995. Each sample is a composite of grabs at three stations. Sediments were collected and examined for trace metals, total PAH, TOC, PCB, ammonia, sulphide, redox potential and particle size. Results of the analyses are presented in Tables 5 and 6. No chemical parameters exceeded the limits specified in the ICTG.

Table 5. Porlier Pass sediment chemistry - October 1995 survey.

	Sediment Chemistry[2]								
Station	**Cd** µg/g	**Hg** µg/g	**Pb** µg/g	**TPAH** µg/g	**TOC** %	**PCB** ng/g	**Ammonia** µg NH_3 - N/g	**Sulphide** µg S/g	**Eh** mV
1-2-3	0.21	0.094	18	0.46	1.09	6.01	103.94 ± 1.48	10.53 ± 0.05	-125 ± 0.47
4-5-6	0.19	0.091	10	0.39	1.05	4.87	74.64 ± 2.37	11.50 ± 0.51	-150 ± 0.47
7-8-9	0.21	0.095	10	0.31	1.13	7.70	107.64 ± 1.22	10.86 ± 0.39	-180 ± 0.47
Reference (10)	0.18	0.088	<8	0.33	1.02	4.67	114.10 ± 3.22	7.04 ± 0.21	-187 ± 0.82

[2] Trace metal analyses are presented as total metals.

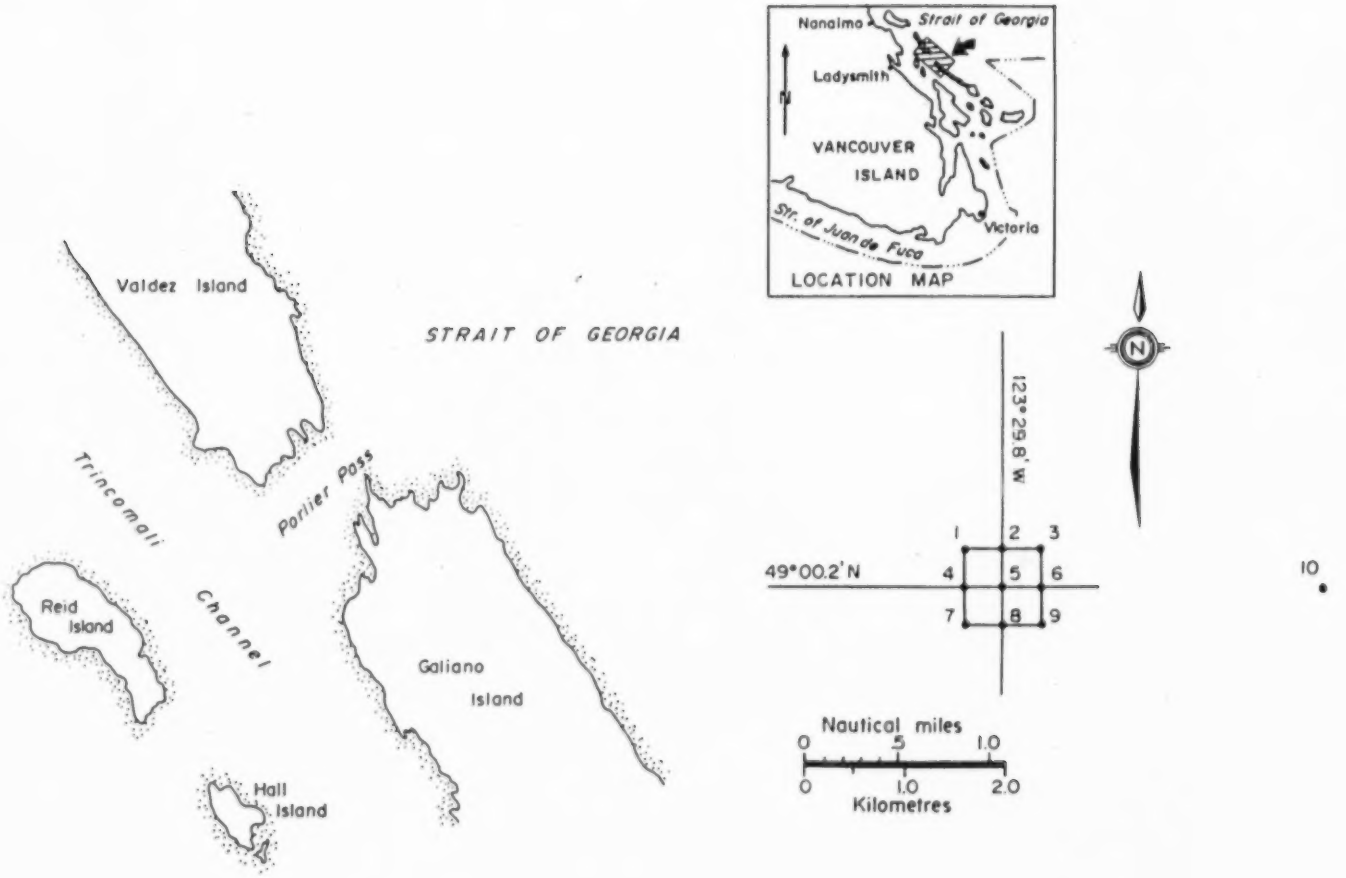


Figure 4. Porlier Pass ocean disposal site and sediment sampling stations.

Three biological test methods were used to determine the toxicity of the site. The results of these tests are presented in Table 6. Toxic responses were observed only in the amphipod test using *E. washingtonianus*. It is likely this toxicity results from the high percentage of silt and clay in the test sediment. A complete discussion of the bioassay test results is included in Sullivan, 1997.

Table 6. Porlier Pass bioassay test results and particle size - October 1995 survey.

Station	Amphipod *E. washingtonianus* % Survival	Amphipod *R. abronius* % Survival	Echinoid *L. pictus* % Fertilization	Microtox Solid-Phase % Effect	% Particle Size Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063-0.004 mm	Clay <0.004 mm
1-2-3	*9.0 ± 6.52	76.0 ± 4.18	56.5 ± 4.65	0.137	2.1	6.6	44.1	49.3
4-5-6	*21.3 ± 16.52	81.0 ± 9.62	57.8 ± 4.50	0.242	2.5	9.5	42.8	47.7
7-8-9	*22.0 ±14.40	82.0 ± 16.81	55.8 ± 4.99	0.143	1.7	7.3	43.5	49.2
Reference	*12.0 ± 4.47	77.0 ± 7.58	58.8 ± 2.99	0.286	0.6	2.2	51.1	46.7
Control	95.0 ± 6.12	92.0 ± 6.71	71.0 ± 2.94	0.100	Not Available			

* Indicates toxic response.

In October 1995, a remotely operated vehicle, ROPOS, was deployed at the Porlier Pass disposal site. Video images of the seabed condition were recorded on transect lines across the disposal site. It was observed that material discharged at the site remains within the disposal site boundaries once it reaches the seabed. It was also noted that there is significant colonization of the disposal site area by many varieties of marine organisms. ROPOS video images can be viewed at Environment Canada, 224 West Esplanade, North Vancouver, B.C.

5.4 FIVE FINGER ISLAND

Disposal Site: Five Finger Island
Number: 40
Co-ordinates: 49°15.20'N; 123°54.60'W
Depth: 280 metres
Total Quantity Disposed Since 1976: 198 812 cubic metres

Comments

For dredging and disposal timing restrictions, contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

In 1995, a total of 3 900 cubic metres of dredged material resulting from annual maintenance activities at Domans, Duke Point, were disposed of at Five Finger Island disposal site.

Monitoring Information

Five Finger Island disposal site was monitored in October 1995. Composite sediment samples were collected and measured for chemical parameters including: trace metals, TPAH, PCB, ammonia, sulphide, redox potential and particle size. Each sample is a composite of grabs at three stations. Chemical results are presented in Tables 7 and 8. All chemical parameters (with the exception of the PCB concentration of composite sample 7-8-9) were within the guidelines specified in the ICTG.

Table 7. Five Finger Island sediment chemistry - October 1995 survey.

	Sediment Chemistry[1]								
Station	**Cd** µg/g	**Hg** µg/g	**Pb** µg/g	**TPAH** µg/g	**TOC** %	**PCB** ng/g	**Ammonia** µg NH3 - N/g	**Sulphide** µg S/g	**Eh** mV
1-2-3	0.32	0.119	19	0.65	1.57	11.9	96.14 ± 3.60	4.16 ± 0.47	-213 ± 0.82
4-5-6	0.37	0.142	24	1.07	2.31	15.2	70.49 ± 3.02	5.25 ± 0.09	-172 ± 4.50
7-8-9	0.29	0.103	20	1.28	1.43	*126	66.17 ± 0.83	2.74 ± 0.21	-166 ± 0.47
Reference (10)	0.38	0.144	31	0.93	< 0.05	10.4	69.64 ± 1.02	3.96 ± 0.10	-190 ± 0.82

* Indicates concentration above ICTG limits.

[1] Trace metal analyses are presented as total metals.

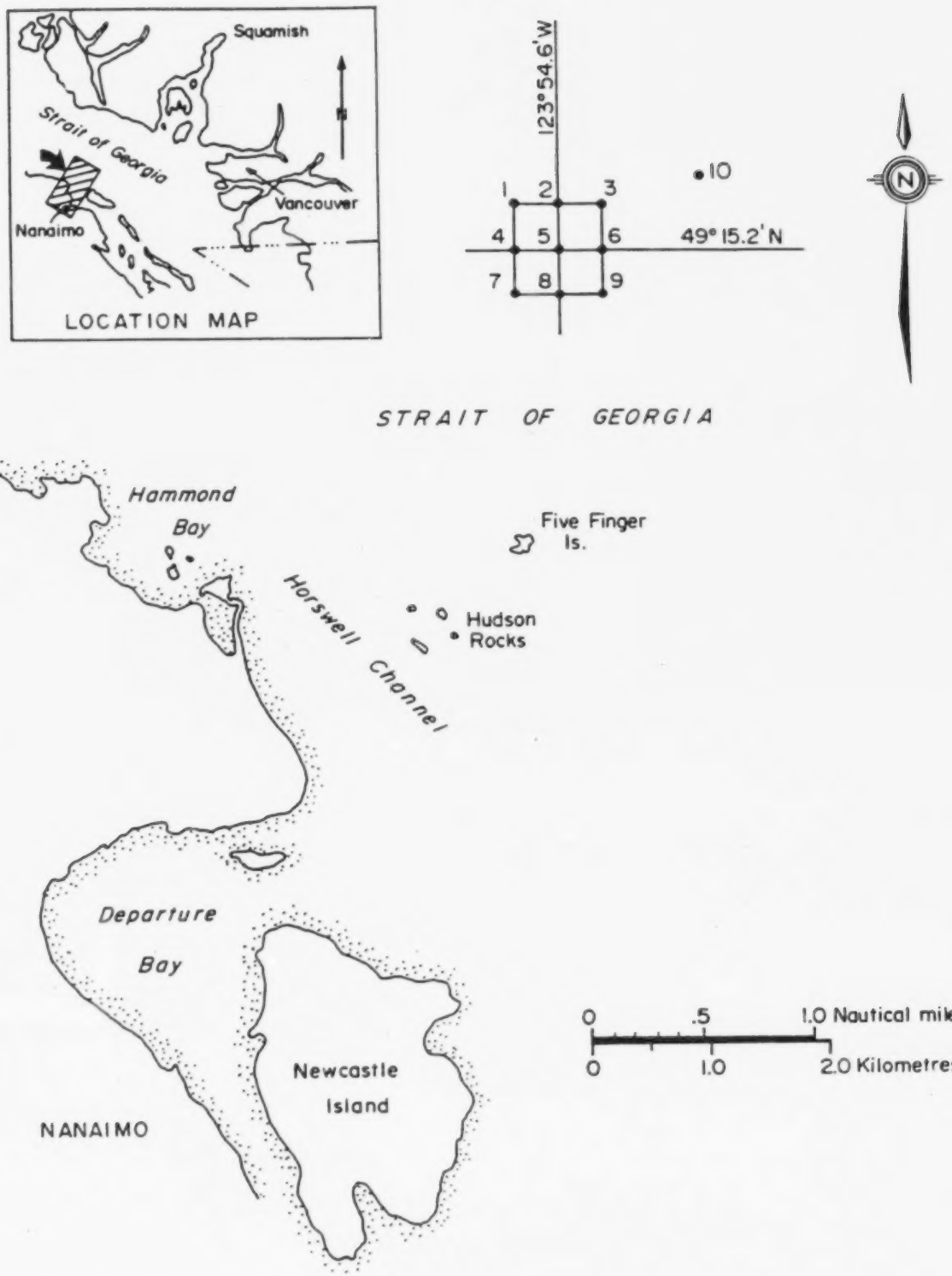


Figure 5. Five Finger Island ocean disposal site and sediment sampling stations.

Biological tests were conducted on the samples from this site. The results are presented in Table 8. Toxic responses were observed in all sediments from the disposal site. Please refer to Sullivan, 1997, for further discussion of the biological test results.

Table 8. Five Finger Island bioassay test results and particle size - October 1995 survey.

Station	Amphipod *E. washingtonianus* % Survival	Amphipod *R. abronius* % Survival	Echinoid *L. pictus* % Fertilization	Microtox Solid-Phase % Effect	% Particle Size Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063-0.004 mm	Clay < 0.004 mm
1-2-3	*22.0 ± 19	67.0 ± 18	55.3 ± 1.3	0.358	0.9	15.9	19.8	64.3
4-5-6	*37.0 ± 16	*59.0 ± 17	*39.5 ± 5.7	0.397	0.8	4.7	21.9	73.4
7-8-9	*45.0 ± 7.1	*58.0 ± 12	*50.5 ± 2.4	0.288	0.4	18.7	23.5	57.8
Reference	*22.0 ± 14	65.0 ± 16	64.0 ± 5.6	0.288	0.7	2.9	21.2	75.9
Control	95.0 ± 6.1	92.0 ± 6.7	71.0 ± 2.9	0.100	Not Available			

* Indicates toxic response.

In October 1995, the ROPOS was deployed at the Five Finger Island disposal site. Video images of the seabed condition were recorded on transect lines across the disposal site. It was observed that material discharged at the site remains within the disposal site boundaries once it reaches the seabed. It was also noted that there is significant colonization of the disposal site area by many varieties of marine organisms. ROPOS video images can be viewed at Environment Canada, 224 West Esplanade, North Vancouver, B.C.

5.5 MALASPINA STRAIT

Disposal Site:	Malaspina Strait
Number:	49
Co-ordinates:	49°45.00'; 124°27.00'W
Depth:	320 metres
Total Quantity Disposed Since 1976:	366 039 cubic metres

Comments

For dredging and disposal timing restrictions, contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

A total of 14 790 cubic metres of material resulting from maintenance dredging at MacMillan Bloedel operations in Stillwater and Powell River was disposed of at Malaspina Strait disposal site in 1995.

5.6 THORMANBY ISLAND

Disposal Site:	Thormanby Island
Number:	114
Co-ordinates:	49°27.50'N; 124°04.50'W
Depth:	384 metres
Total Quantity Disposed Since 1976:	6 050 cubic metres

Comments

For specific timing restrictions for dredging, please contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

A total of 350 cubic metres of dredged material was disposed of at the Thormanby Island disposal site in 1995. This material resulted from maintenance dredging at Secret Cove.

5.7 CAPE MUDGE

Disposal Site:	Cape Mudge
Number:	116
Co-ordinates:	49°57.70'N; 125°05.00'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	145 853 cubic metres

Comments

The Department of Fisheries and Oceans generally prohibits dredging/loading activities during the period December 1st to March 15th in the Campbell River area to protect salmon stocks and to minimize disruption of the local sport fishery.

For specific dredging and disposal timing restrictions, contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

A total of 7 200 cubic metres of dredged material from MacMillan Bloedel operations in Menzies Bay and from the Dolphins Resort was disposed of at this disposal site in 1995.

5.8 JOHNSTONE STRAIT - HICKEY POINT

Disposal Site:	Johnstone Strait - Hickey Point
Number:	119
Co-ordinates:	50°27.80'N; 126°04.80'W
Depth:	270 metres
Total Quantity Disposed Since 1976:	150 588 cubic metres

Comments

Department of Fisheries and Oceans generally requests that dredging/loading activities be scheduled during the period November 1st to February 28th to protect fishery resources and minimize interference with recreational fishing.

For specific dredging and disposal timing restrictions, contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

In 1995, 8 400 cubic metres of dredged material from MacMillan Bloedel operations in Eve River and Kelsey Bay and from Naka Creek in Johnstone Strait was disposed of at this site.

5.9 JOHNSTONE STRAIT - HANSON ISLAND

Disposal Site:	Johnstone Strait - Hanson Island
Number:	120
Co-ordinates:	50°33.50'N; 126°48.00'W
Depth:	350 metres
Total Quantity Disposed Since 1976:	170 556 cubic metres

Comments

The Department of Fisheries and Oceans generally prohibits dredging/loading activities during the period November 1st to February 28th to protect fishery resources and avoid interruption of the local sport fishery.

For specific dredging and disposal timing restrictions, contact the Department of Fisheries and Oceans Habitat Management Unit in Nanaimo.

Loadsite Information

A total of 6 000 cubic metres of dredged material from various forest related industries in Port McNeill and Beaver Cove was disposed of at this site in 1995.

5.10 ROBERTS BANK - STRAIT OF GEORGIA

Disposal Site:	Roberts Bank - Strait of Georgia
Number:	126
Co-ordinates:	49°00.70'N; 123°10.50'W
Depth:	40 metres
Total Quantity Disposed Since 1976:	698 000 cubic metres

Comments

The Department of Fisheries and Oceans Habitat Management Unit in New Westminster should be contacted for specific timing restrictions for dredging.

Loadsite Information

In 1995, 191 000 cubic meters of dredged material was sent to the Roberts Bank disposal site. This material resulted from the expansion of the Vancouver Port Corporation Roberts Bank Terminal.

5.11 Rum Island - Haro Strait

Disposal Site:	Rum Island - Haro Strait
Number:	166
Co-ordinates:	48°40.06'N; 123°17.10'W
Depth:	31 metres
Total Quantity Disposed Since 1976:	2 400 tonnes

Comments

This disposal site was established for the disposal of a vessel as a SCUBA diving attraction. There have been no other disposal activities at this site.

Loadsite Information

The *Mackenzie*, a decommissioned naval destroyer, was sunk in Haro Strait in September, 1995, by the Artificial Reef Society of British Columbia. All floatables, fuel oil, hydraulic fluids, lubricants and other petroleum-based products were removed from the vessel prior to sinking.

6.0 References

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Sullivan, D.L., D.E. Brothers, K. Kim and C. Schnider. 1997. Ocean disposal activities summary for Pacific and Yukon Region 1994. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-02.

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Ward, A.B. and D.L. Sullivan. 1980. A review of existing and historical ocean dumpsites in the Pacific Region. Environment Canada, Environmental Protection Service, Pacific Region. Regional Program Report: 80-5.

APPENDICES

APPENDIX I

Ocean Disposal Site Summaries

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Point Grey
Number 1
Lattitude 49°15.40
Longitude 123°22.10
Depth (m) 210

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3105	FRNA-ENNO'S MARINA	14-Feb-95	31900 m3
	3107	FRNA-BRIDGEPOINT MARINA	15-Jan-95	13711 m3
	3108	FRNA-RICHMOND PLYWOOD	14-Jan-95	1000 m3
		FR-CIPA LUMBER	13-Mar-95	750 m3
		FR-DELTA CEDAR	18-Mar-95	1500 m3
		FRNA-TERMINAL SAWMILL	25-Mar-95	3000 m3
		FRNA-MAINLAND SAWMILL	01-Apr-95	4000 m3
		FR-MILL & TIMBER	14-Apr-95	4000 m3
	3111	FRNA-MB-NW	03-Jun-95	465 m3
	3112	FR-ACORN-PRIMEX	13-Mar-95	1500 m3
		FRNA-WEST COAST CELLUFIBRE	19-Mar-95	1500 m3
		FRNA-WESTERN WHITEWOOD	11-May-95	500 m3
		FRNA-LAFARGE-KENT ST	25-May-95	1000 m3
	3117	FR-FRASER PULP CHIP	19-Oct-95	3800 m3
	3122	FRNA-ARROW #5	19-Mar-95	1800 m3
		FRNA-GOLDWOOD IND	08-Apr-95	3000 m3
	3126	FRNA-RICHMOND PLYWOOD	18-Nov-95	3000 m3
	3130	FRNA-SILVERTREE SAWMILLS	14-Jun-95	4000 m3
		FRNA-FLETCHER CHALLENGE	10-Jul-95	4000 m3
		FRNA-SCOTT PAPER LTD	16-Sep-95	700 m3
		FRNA-WESTERN WHITEWOOD	29-Sep-95	700 m3
		FRNA-SILVERTREE SAWMILLS	11-Nov-95	4000 m3
		FR-CONAG-MARPOLE	14-Nov-95	750 m3
		FR-CONAG-MITCHELL ISLAND	14-Nov-95	750 m3
		FR-CONAG-DUCK ISLAND	15-Nov-95	3000 m3
		FRNA-CONAG-REMPLE	17-Nov-95	1500 m3
		FRNA-RICHMOND PLYWOOD	18-Nov-95	3000 m3
		FR-COLUMBIA BITULITHIC	20-Nov-95	1400 m3
		FR-CIPA LUMBER	24-Nov-95	1000 m3
		FR-MILL & TIMBER	27-Dec-95	4000 m3
	3131	FR-NORVIK LUMBER	30-May-95	3000 m3
		FRNA-VAN SAWMILL	03-Jun-95	3000 m3
		FRNA-WEST COAST CELLUFIBRE	12-Jun-95	3000 m3
		FRNA-FLETCHER CHALLENGE	16-Jun-95	3000 m3
		FR-MACKENZIE MILLS	13-Aug-95	750 m3
		FR-ACORN-PRIMEX	08-Sep-95	1500 m3
		FRNA-EBURNE	09-Oct-95	1000 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Dredge	3131	FR-LAFARGE-COQ	16-Oct-95	1500 m3
	3132	FR-DELTA CEDAR	05-Jul-95	9000 m3
		FR-DELTA CEDAR	12-Nov-95	1000 m3
	3133	FR-S&R SAWMILLS	13-Sep-95	49279 m3
	3135	FR-FRASER PULP CHIP	20-Nov-95	3855 m3
		FR-TEAL CEDAR	23-Nov-95	2866 m3
		FRNA-WEST COAST CELLUFIBRE	18-Dec-95	3700 m3
	3138	FRNA-CANADIAN WHITE PINE	31-Jul-95	7000 m3
		FRNA-MB-NW	08-Aug-95	6750 m3
	3141	VAN HBR-NOVA LUMBER	15-Jul-95	1300 m3
			Total Dredge Quantity:	206726 m3
Excavation	3115	LOWER MAINLAND-BEL	31-Jan-95	7254 m3
		LOWER MAINLAND-BEL	28-Feb-95	24901 m3
		LOWER MAINLAND-BEL	31-Mar-95	20319 m3
		LOWER MAINLAND-BEL	30-Apr-95	14105 m3
		LOWER MAINLAND-BEL	31-May-95	26124 m3
		LOWER MAINLAND-BEL	30-Jun-95	26078 m3
	3118	LOWER MAINLAND-MILLER	31-Jan-95	7290 m3
		LOWER MAINLAND-MILLER	28-Feb-95	7500 m3
		LOWER MAINLAND-MILLER	31-Mar-95	41769 m3
		LOWER MAINLAND-MILLER	30-Apr-95	14668 m3
		LOWER MAINLAND-MILLER	31-May-95	20731 m3
		LOWER MAINLAND-MILLER	01-Jun-95	8148 m3
		LOWER MAINLAND-MILLER	01-Aug-95	6790 m3
	3136	LOWER MAINLAND-MILLER	22-Aug-95	10675 m3
		LOWER MAINLAND-MILLER	01-Sep-95	14755 m3
		LOWER MAINLAND-MILLER	01-Oct-95	22924 m3
		LOWER MAINLAND-MILLER	01-Nov-95	14377 m3
		LOWER MAINLAND-MILLER	01-Dec-95	12232 m3
	3140	LOWER MAINLAND-BEL	04-Jul-95	13735 m3
		LOWER MAINLAND-BEL	01-Aug-95	3400 m3
		LOWER MAINLAND-BEL	01-Sep-95	12740 m3
		LOWER MAINLAND-BEL	01-Oct-95	29705 m3
		LOWER MAINLAND-BEL	01-Nov-95	17076 m3
		LOWER MAINLAND-BEL	01-Dec-95	15279 m3
			Total Excavation Quantity:	392575 m3
			Total Disposal Site Quantity:	599301 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Sand Heads
Number 9
Lattitude 49°06.00
Longitude 123°19.50
Depth (m) 70

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3106	FR-TILBURY ISLAND-BCFP/CN	05-Jan-95	58447 m3
	3116	FR-OCEAN FISH-RICE MILL	14-Feb-95	1500 m3
	3124	FR-MAINTENANCE	01-Aug-95	603783 m3
	3130	VAN IS-TSEHUM HBR-MARINAS	06-Nov-95	350 m3
		FR-CONAG-DELTA	21-Nov-95	1500 m3
		FR-GENSTAR-TILBURY ISLAND	27-Nov-95	4000 m3
		FR-CONAG-SURREY	30-Nov-95	1500 m3
		Total Dredge Quantity:		671080 m3
Excavation	3123	FR-ANNACIS ISLAND-GVRD	08-Feb-95	23000 m3
		FR-ANNACIS ISLAND-GVRD	20-Apr-95	30000 m3
		Total Excavation Quantity:		53000 m3
		Total Disposal Site Quantity:		724080 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Porlier Pass
Number 32
Lattitude 49°00.20
Longitude 123°29.80
Depth (m) 200

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3122	VAN IS-LADYSMITH-CPFP-DRYSOR	13-Mar-95	1800 m3
		VAN IS-CHEMAINUS-SAWMILL	04-Aug-95	1800 m3
		VAN IS-CHEMAINUS-MB-DRYSORT	08-Aug-95	1800 m3
			Total Dredge Quantity:	5400 m3
			Total Disposal Site Quantity:	5400 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Five Finger Island
Number 40
Lattitude 49°15.20
Longitude 123°54.60
Depth (m) 280

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3142	VAN IS-DOMANS-DUKE PT	30-Jun-95	2500 m3
		VAN IS-DOMANS-DUKE PT	03-Jul-95	1400 m3
			Total Dredge Quantity:	3900 m3
			Total Disposal Site Quantity:	3900 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Malaspina Strait
Number 49
Lattitude 49°45.00
Longitude 124°27.00
Depth (m) 320

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3121	STILLWATER	17-Sep-95	1800 m3
	3143	POWELL RIVER	05-Sep-95	12990 m3
			Total Dredge Quantity:	14790 m3
			Total Disposal Site Quantity:	14790 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Thormanby Island
Number 114
Lattitude 49°27.50
Longitude 124°04.50
Depth (m) 384

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3130	SECRET COVE	23-Jun-95	350 m3
			Total Dredge Quantity:	350 m3
			Total Disposal Site Quantity:	350 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Cape Mudge
Number 116
Lattitude 49°57.70
Longitude 125°05.00
Depth (m) 200

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3121	VAN IS-MENZIES BAY-MB-DRY SO	01-Jan-95	2400 m3
		VAN IS-MENZIES BAY-MB-WET SO	26-Jan-95	2400 m3
		VAN IS-MENZIES BAY	29-Jan-95	600 m3
		VAN IS-DISCOVERY PASSAGE	02-Feb-95	600 m3
	3145	VAN IS-MENZIES BAY-MB-DRY SO	15-Dec-95	1200 m3
			Total Dredge Quantity:	7200 m3
			Total Disposal Site Quantity:	7200 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Johnstone Strait-Hickey Point
Number 119
Lattitude 50°27.80
Longitude 126°04.80
Depth (m) 270

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3121	VAN IS-KELSEY BAY-MB	02-Jan-95	1800 m3
		VAN IS-EVE RIVER	05-Jan-95	1800 m3
	3145	VAN IS-EVE RIVER	18-Dec-95	3000 m3
		VAN IS-JOHNSTONE STR-NAKA	28-Dec-95	1800 m3
			Total Dredge Quantity:	8400 m3
			Total Disposal Site Quantity:	8400 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Johnstone Strait-Hanson Island
Number 120
Lattitude 50°33.50
Longitude 126°48.00
Depth (m) 350

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3121	VAN IS-PORT MCNEILL-MB	07-Jan-95	2400 m3
		VAN IS-BEAVER COVE-CANFOR	10-Jan-95	1800 m3
		VAN IS-PORT MCNEILL-WESTERN	14-Jan-95	1200 m3
	3145	VAN IS-PORT MCNEILL-MB	31-Dec-95	600 m3
			Total Dredge Quantity:	6000 m3
			Total Disposal Site Quantity:	6000 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Roberts Bank - St of Georgia
Number 126
Lattitude 49°00.70
Longitude 123°10.50
Depth (m) 40

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3137	ROBERTS BANK	01-Jul-95	191000 m3
			Total Dredge Quantity:	191000 m3
			Total Disposal Site Quantity:	191000 m3

Disposal Site History Report

For Disposal Activities Between 1/1/95 and 12/31/95

Disposal Site Rum Island-Haro Strait
Number 166
Lattitude 48°40.06
Longitude 123°17.10
Depth (m) 31

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Vessel	3129	VAN IS-PAT BAY	16-Sep-95	2400 tonnes
			Total Vessel Quantity:	2400 tonnes
			Total Disposal Site Quantity:	2400 tonnes

APPENDIX II

Interim Contaminant Testing Guidelines for Ocean Disposal Pacific and Yukon Region (1997 March)

INTERIM CONTAMINANT TESTING GUIDELINES FOR OCEAN DISPOSAL PACIFIC AND YUKON REGION (1997 MARCH)

In response to growing concern over the biological implications of contaminants in marine sediments along the Canadian coastline, Environment Canada (EC), Pacific and Yukon Region (P&Y), in consultation with the Regional Ocean Disposal Advisory Committee (RODAC), has developed the following guidelines for sampling, analysis and reporting associated with proposed ocean disposal activities.

Under Schedule III, Part III of the Canadian Environmental Protection Act (CEPA), EC (P&Y) must consider the availability of practical alternative disposal options. To satisfy this requirement the applicant must provide a written record of the decision-making process used in selecting ocean disposal as the alternative of choice for disposal of materials. Disposal at sea is only permitted for materials where it is the environmentally preferable and practical alternative.

To assess the potential for environmental impacts of Ocean Disposal, EC (P&Y) will require chemical analyses to be performed on any material where there is a lack of chemical data, or a reason to believe that contaminants such as selected trace metals or organics are present. The minimum number of samples and the analyses required is specified in the following tables; the number of samples and the analyses required may be increased by EC (P&Y) in some instances. A proposed sampling program should be developed by the applicant, based on information provided in the following tables, and submitted to EC (P&Y) for approval prior to commencement of loading/ocean disposal activities.

Materials found to contain substances of concern at or higher than the regulated or guideline concentrations identified in the following tables may be considered for ocean disposal under section 71(3) of CEPA if they pass a series of biological tests. A tiered assessment approach using biological testing is used for this determination. The procedures for these tests are described in the document entitled "Interim Guidance for Application of Rapidly Rendered Harmless (RRH) and Trace Contaminants", which is available upon request from EC (P&Y). Ocean disposal options such as capping, containment, and side-casting, suggested by an applicant, will be considered by EC (P&Y), but their acceptance will be conditional on compliance with RRH protocols.

SAMPLING AND ANALYSIS REQUIREMENTS

The following pages identify the minimum sampling and analytical requirements for dredged and excavated materials based on the size of the project, as well as rejection/screening limits currently used by EC (P&Y). Sampling requirements will be tailored on a site specific basis at the discretion of EC (P&Y), and analysis of other parameters may be requested when EC (P&Y) has reason to believe that other contaminants are present.

MINIMUM REQUIREMENTS FOR DREDGED MATERIALS

SAMPLING REQUIREMENTS

All samples are analysed for minimum requirements.

Project Quantity (m^3)	Permit Type	Minimum # of Samples	Type of Sampling
0 - 4,000	General *	3 (1) **	• surface sampling prior to loading
0 - 10,000	Site-Specific	3 (1)	• surface sampling prior to loading
10,000 - 30,000	Site-Specific	3 (1) 3 (1) **or** 6 (2)	• surface sampling prior to loading • sampling to depth prior to loading • surface sampling prior to loading • may require additional sampling during dredging
30,000 - 60,000	Site-Specific	4 (2) 4 (2)	• surface sampling prior to loading • sampling to depth prior to loading
>60,000	Site-Specific	• sampling requirements to be determined on a project specific basis	

* General Permits are multi-loadsite permits issued to applicants, and are specific to disposal from maintenance dredging projects of less than 4000 cubic metres.

** The brackets indicate the number of *composite* samples to be analysed initially for dioxins/furans, if requested by EC (P&Y).

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

For PAH, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Interim Quality Assurance Guidelines for Determination of Polynuclear Aromatic Hydrocarbons in Marine Sediments for Ocean Disposal', a copy of which is available from EC (P&Y).

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested. Additional parameters may include the following:

	Parameter	Limit of Detection
Trace Metals	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
	Lead (Pb)	10 µg/g
Organics	PCB	0.05 µg/g
	PCP	0.05 µg/g
	Dioxins/furans	10 pg/g for T_4CDD

The analysis results are to be reported on a dry weight basis with detection limits less than or equal to those stated above. The precision of the test method should be indicated by reporting analyses on five replicate sub-samples on 10% of the trace metal samples, and two replicate sub-samples on 20% of the organics samples, with a minimum of one replicated sample. Sub-sampling should be done following homogenizing but prior to digestion of the sample and the replicates should not be run consecutively. The accuracy of the test method should be indicated by reporting the results of certified reference materials analysed at the same time as the test samples.

For dioxin/furan, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Internal Quality Assurance Requirements for Analysis of Dioxins in Environmental Samples', a copy of which is available from EC (P&Y).

MINIMUM REQUIREMENTS FOR EXCAVATION MATERIALS*

* "General" Permits for excavation spoils are restricted to the loading and ocean disposal of *undisturbed, native material*. For other excavated materials, a site specific permit will be required.

SAMPLING REQUIREMENTS

Project Quantity (m^3)	Minimum Number of Samples	Type of Sampling
0 - 10,000	3	• composite of surface native material to one metre depth
10,000 - 30,000	6	• composite of surface native material to one metre depth
30,000 - 60,000	8	• composite of surface native material to one metre depth
> 60,000	sampling requirements to be determined on a project specific basis	

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
	Lead (Pb)	10 µg/g
	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested.

The analysis results are to be reported as stipulated under Table 1. Minimum requirements for dredged materials.

REJECTION/SCREENING LIMITS

Parameter	Rejection/Screening Limit (µg/g dry weight)
Cadmium	0.6 µg/g
Mercury	0.75 µg/g
Arsenic Copper Zinc Beryllium Chromium Nickel Vanadium Lead	* 0.1 % or more by weight or 1000 µg/g
Chlorophenols (PCP) (penta and tetra isomers)	1.0 µg/g
Polychlorinated biphenyls (PCB)	0.1 µg/g
PAH (total)	2.5 µg/g
Dioxin/Furan	"quantifiable" 2,3,7,8 TCDD

* These levels are defined as "significant amounts" as agreed to by Canada as a signatory to the London Convention (LC); if exceeded, special care measures are required for disposal. *EC (P&Y) considers these levels as general guidelines only and may impose more stringent limits.*

STEPS REQUIRED FOR COLLECTING SAMPLES AND SUBMITTING ANALYTICAL DATA

Prepare the following information:

1) a location map for the dredge/excavation site with the the street address of the proposed excavation or dredge site,
2) a site map showing the proposed excavation or dredge site relative to known landmarks and/or streets,
3) a list of any known possible contaminant input sources in the vicinity of the proposed works,
4) a written record of the decision making process used in selecting ocean disposal as the preferred materials disposal option, explaining why other disposal methods are not being used,
5) a site use history for the site from which the material destined for ocean disposal will originate, and
6) a proposed sampling plan of the site showing the proposed sampling locations, and a list of proposed analyses. The proposed sampling plan should be developed based on information presented in this document. Assistance in designing a sampling program can be provided by Environment Canada (EC), Pacific and Yukon Region (P&Y). *The sampling program must be approved prior to taking the samples.*

The information identified above should be sent to EC (P&Y). If the project does not qualify for completion under the terms and conditions of a "General" permit, this information should be submitted with a completed Ocean Disposal Application form. For information on how to apply, please contact EC (P&Y).

If the project qualifies for completion under a "General" Ocean Disposal Permit, this information must be submitted to EC (P&Y) with a covering letter describing the proposed activities in detail, and the proposed schedule for the work. Upon completion of the sampling and analyses program, the test data, together with all QA/QC data as identified in the foregoing information, must be sent to EC (P&Y).

No work may proceed under a "General" Permit until written approval for the specific site has been received from EC (P&Y), and a copy of the approval letter is posted at the work site.

For further information on this document, or any other matter relating to Ocean Disposal, please contact the following:

Dixie Sullivan	(604) 666-2730
Duane Brothers	(604) 666-0724
Cathy Schnider	(604) 666-2685

GENERAL GUIDE TO SOIL AND SEDIMENT SAMPLE COLLECTION

Containers for the samples should be obtained from the laboratory contracted to conduct the required analyses. Avoid unnecessary contact with clean glassware and utensils. A clean stainless steel or teflon spoon or scoop is ideal for transferring samples. Handle containers by the outsides only. Do not touch the inside of the jar, or teflon (or foil) liners, and use spoons or scoops by the handles only. When removing a foil or teflon liner and lid from a jar, remove as one piece and put down on a piece of foil or other clean surface while filling the jar.

If using a grab sampler, remove the water from the surface of the grab, taking care not to disturb the contents if possible. Use the clean scoop to remove a portion of the sediment from the middle of the sampler down to the depth of the material caught in the grab. The material in the sample jar should be representative of the material to be loaded for ocean disposal.

Alternatively, the sample may be taken by removing the lid, holding the jar by the sides and scooping the sample from the sediment without the use of other utensils. The threads of the jar may then be wiped with a paper towel before replacing the lid. Do not fill the jar more than about 3/4 full, allowing plenty of room for mixing/stirring, and expansion during freezing.

When the sample is in the jar, replace the teflon/foil liner and lid, and label the jar with project identification, the sampling site number, and the date.

To clean the sampling spoon or grab in-between samples, wipe with a paper towel to remove any solids, then rinse with water. Clean the tray in this manner as required.

If three samples are required for analysis, three small jars of sediment should be taken for *each* sampling station, for a total of nine jars. The three jars per sample will be composited by the analytical lab by taking equal aliquots of sample from each jar for a single analysis of most parameters of concern. The samples may be further composited for other testing as required but would otherwise be maintained as discrete samples.

Keep the samples in a refrigerator or on ice for short term storage (1-2 days); freeze the sample as soon as possible or store over dry ice for long term storage. The laboratory responsible for the analyses should be asked to freeze the samples after removal of sufficient material to complete the required analyses. These samples should remain frozen until the permit, or approval under a general permit, has been issued by EC (P&Y).

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